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IS 10462-2 (1991): Fictitious calculation method for determination of dimensions of protective coverings of cables, Part 2: Paper insulated cables [ETD 9: Power Cables]



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भारतीय मानक

केबल संरक्षी खोलों के आयाम निर्धारण के लिए काल्पनिक
परिकलन पद्धति का मसौदा

भाग 2 - कागज रोधित केबल

Indian Standard

FICTITIOUS CALCULATION METHOD FOR
DETERMINATION OF DIMENSIONS OF
PROTECTIVE COVERING OF CABLES

PART 2 PAPER INSULATED CABLES

UDC 621.315.221 : 621.315.614.6

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BUREAU OF INDIAN STANDARDS
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FOREWORD

This Indian Standard (Part 2) was adopted by the Bureau of Indian Standards, after the draft finalized by the Power Cables Sectional Committee had been approved by the Electrotechnical Division Council.

Indian Standards on cables specify some of the parameters, such as thickness of covering and type of armouring material on the basis of calculated nominal cable diameters which are not necessarily the same as actual values achieved in production.

To avoid variation in shaped conductor dimensions and method of calculation from manufacturer, a fictitious calculation method has been devised. The idea is to ignore the shape and degree of compactness of conductors and to calculate fictitious diameters from formulae based on the cross-sectional area of conductor, insulation thickness and number of cores. Various parameters which are independent of slight difference in manufacturing practices are then related to fictitious diameters by formulae or by tables. This method helps in standardizing cable designs, different parameters being pre-calculated and specified for each size of cables.

The fictitious calculation is used only to determine dimensions of sheaths and cable coverings. It is not a replacement for the calculation of normal diameters required for practical purposes, which should be calculated separately.

The details regarding fictitious calculations for elastomeric and thermoplastic insulated cables are covered in Part 1 of this standard.

In preparing this standard, assistance has been derived from IEC Publication 55-2 'Paper insulated metal-sheathed cables for rated voltages up to 18/30 kV (with copper or aluminium conductors) : Part 2 General and construction requirements', issued by the International Electrotechnical Commission (IEC).

The calculated value of fictitious diameter at each stage shall be rounded off to one significant place of decimal, that is, 0.1 mm, before proceeding to next step. The rounding off shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'.

Indian Standard

FICTITIOUS CALCULATION METHOD FOR DETERMINATION OF DIMENSIONS OF PROTECTIVE COVERING OF CABLES

PART 2 PAPER INSULATED CABLES

1 SCOPE

This standard covers the fictitious calculation method of determination of dimensions of protective coverings of paper insulated cables [see IS 692 : 1973 'Paper insulated lead-sheathed cables for electricity supply (second revision)'].

2 REFERENCE

Indian Standard IS 10462 (Part 1) : 1983 'Elastomeric and thermoplastic insulated cables' is a necessary adjunct to this standard.

3 SYMBOLS

The symbols used in this standard and the quantities denoted by them are given below:

d_L = fictitious diameter of conductor

D_c = fictitious diameter of core (in case of $3\frac{1}{2}$ cores, full core is denoted by D_{c1} and half core, that is, core having reduced neutral conductor, by D_{c2})

D_f = fictitious diameter under lead sheath

D_{pb} = fictitious diameter over lead sheath

D = fictitious diameter over laid up cores (see also D_{SL})

D_{SL} = fictitious diameter over laid up sheathed cores under bedding for separate lead sheathed (SL) cables

D_B = fictitious diameter over bedding

D_u = fictitious diameter under extruded outer sheath

t_i = thickness of insulation

t_b = thickness of belt

t_{pb} = thickness of lead sheath

t_p = thickness of bedding

t_a = diameter of armour wire or thickness of strip or tape

NOTE — Thickness/diameter t_i , t_b , t_{pb} , t_p and t_a are the values as specified in the relevant cable specification.

4 METHOD OF CALCULATION

4.1 Conductors

The fictitious diameter, d_L , of a conductor, irrespective of shape or compactness, is given for each nominal cross section in Table 1.

4.2 Cores

The fictitious diameter, D_c , of any core is given by:

$$D_c = d_L + 2 t_i$$

where t_i is the thickness of the insulation as given in relevant cable specification.

4.3 Diameter Over Laid Up Cores

The fictitious diameter over laid up cores, D or D_{SL} , is given by the following:

a) For two-core cables:

$$D = D_c \times 2$$

b) For three-core cables:

$$D = D_c \times 2.16$$

c) For three-core SL cables having lapped bedding:

$$D_{SL} = D_{pb} \times 2.16$$

d) For three-core SL cables having extruded bedding:

$$D_{SL} = (D_{pb} + 2 t_p) \times 2.16$$

e) For $3\frac{1}{2}$ core cables:

$$D = \frac{3 D_{c1} + D_{c2}}{4} \times 2.42$$

f) For four-core cables:

$$D = D_c \times 2.42$$

g) For five-core cables:

$$D = D_c \times 2.7$$

4.4 Diameter Under Lead Sheath

The fictitious diameter under lead sheath, D_f is, given by the following:

- a) For belted cables:

$$D_f = D + 2 t_b$$

- b) For screened cables:

$$D_f = D \quad (\text{ see 4.3 })$$

- c) For SL cables:

$$D_f = D_c \quad (\text{ see 4.2 })$$

4.5 Diameter Over Lead Sheath

The fictitious diameter over lead sheath, D_{pb} , is given by:

$$D_{pb} = D_f + 2 t_{pb}$$

4.6 Diameter Over Bedding (or Under Armour)

The fictitious diameter over bedding, D_B , is given by:

$$D_B = D_{pb} \text{ or } D_{SL} + 2 t_p$$

4.7 Diameter Over Armour (or Under Extruded Outer Sheath)

The fictitious diameter D_u , under extruded outer sheath is given by the following:

- a) For wire and strip armoured cables:

$$D_u = D_B + 2 t_a$$

- b) For tape armoured cables:

$$D_u = D_B + 4 t_a$$

Table 1 Fictitious Conductor Diameter Used for Calculations

(Clause 4.1)

Nominal Cross-Sectional Area of Conductor	Fictitious Diameter of Conductor	Nominal Cross-Sectional Area of Conductor	Fictitious Diameter of Conductor
(1)	(2)	(1)	(2)
mm ²	mm	mm ²	mm
1.5	1.4	120	12.4
2.5	1.8	150	13.8
4	2.3	185	15.3
6	2.8	240	17.5
10	3.6	300	19.5
16	4.5	400	22.6
25	5.6	500	25.2
35	6.7	630	28.3
50	8.0	800	31.9
70	9.4	1 000	35.7
95	11.0		

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